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AIRPORT TERMINAL BUILDING DESIGN

by H. Orville Varty

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AIRPORT TERMINAL BUILDING DESIGN

H. Orville Varty[1]

Rare indeed is the Airport Terminal Building, built before World War II, that is now adequately serving its community's needs for today's air travelers. Unfortunately, many terminals built immediately after the war, like their predecessors, failed to function in the best interest of the traveler, the owner, the airlines and the concessionaire - the needs of all we will discuss later.

By no stretch of the imagination do I suggest dereliction on the part of architects and engineers who designed these terminal buildings. I am sure each was doing his best to provide suitable facilities for the air transportation of that day. Unfortunately the industry was not sufficiently stabilized to permit translation of requirements to criteria.

To further trace the chaotic past of Airport Terminal design would be repeating history most of us have observed. I think we can say that a community witnessing the antiquation of a public facility in less than a decade had, or has, a bitter pill to swallow, and rightfully so.

In the early part of 1950 the Civil Aeronautics Administration's Office of Airports set about development of criteria for the layout and design of Airport Terminal Buildings. It was my pleasure to have received this assignment from Mr. Phillips Moore, then Director of the Office of Airports, to develop this much needed criteria. Researching available publications revealed precious little information. Airport management, concessionaires and the Airlines were extremely helpful in supplying information and data they developed, individually. You may recall that collectively for some 5 years the airlines attempted to develop standardized criteria for passenger terminal design - and to use a colloquialism - their project died on the vine.

We conducted an intensive study of the space requirements of consistent occupants of airport terminal buildings. At the same time we were studying passenger and visitor and peak hour relationships developed from time and motion counts at a representative group of airports throughout the United States.

Evaluation of data and information submitted by airlines, concessionaires and airport management indicated that each had special interests and that each often tended to be intolerant of the needs and requirements of the others. Thus we were faced with the problem of who should get the "break" in space allocation and location. The problem is still unanswered but it resolves itself to this. An Airport Terminal Building is primarily the service center for the transfer of passengers and their property between surface vehicles and aircraft. Therefore, it is my contention that the number one consideration should go to the passenger to make his transition as easy as possible. Secondly, the "break" should go to the airline on whom the passenger is dependent for expeditious processing through the terminal. Next in line is the concessionaire who foots many of the bills for the operation of the terminal and provides essential services for the traveler and visitor. Lastly, we must consider accommodating the visitors who often exceed the passengers in number.

1. Steward and Skinner, Architects, Miami 32, Florida.

You will notice, to this point, we have not mentioned the "break" due the airport owner. Naturally an architect or engineer owes his first allegiance to his client. So in developing the scheme for a terminal building, it is probably the owner who gets the number one break on the design of the facility. It is his lot to operate the building to the satisfaction of all and if possible, at a profit. This he will do provided the users of the building get their "breaks" as they should.

At practically every major airport the dollar investment in building construction, that is all buildings on the airport, will exceed the investment in the construction of the landing facilities. This is a point which serves to emphasize the importance of carefully considering all the factors of building area site selection and layout to achieve a solution of maximum utility. Failure to take these factors into account in the initial planning of an airport or any of its facilities, leads to future financial pitfalls resulting from cramped and poorly planned building areas. The operational aspects of a building area poorly planned often result in dollar penalties that are economically unbearable to the Airport owner and the user alike.

Time will not permit us to discuss fully the master planning of the building area in all its aspects; however, I feel a few words on this topic are timely because of the over-all concept of airport planning and the effect on the terminal building. Safe and direct circulation for pedestrians, vehicles and aircraft is the key note of building area planning, bearing in mind that most airports are built in stages to meet current and anticipated aeronautical requirements. This suggests a master plan layout depicting the various stages from the initial through to the ultimate development. The master plan layout of the entire airport and particularly the building area must allow for expansion of any facility in addition to being inherently flexible to permit accommodation of the continually changing pattern of airport activities. Flexibility and expansibility are axiomatic when planning airport facilities.

Now to the design of the terminal building itself.

One of the designer's problems is the development of a simple and direct circulatory scheme for enplaning and deplaning passengers and their baggage between the vehicular loading platform on one side and the aircraft loading positions on the other side of the building. (SEE FIGURE I) To achieve this, there have been several operational systems developed. It appears that often in the past the choice of an operational system, resulted from the designer's desire to experiment. While in many cases these experiments proved to be a burden on the traveling public, they did pave the way for an evaluation of their good and bad points to permit a more scientific determination of the proper system to employ. Generally speaking, the centralized system wherein the ticketing and baggage facilities of all airlines are housed in the same building has proved to be the one affording the greatest number of "breaks" to all concerned.

The unit or decentralized system wherein each airline is housed in a separate, or elongated, building and has its own facilities for processing passengers, baggage, cargo, and accommodating visitors, has generally fallen into disfavor with the industry.

Because of the complexity of circulation within and about airport terminal buildings and the dangers of cross-circulation, it is necessary to afford a separation of these various types of traffic. At airports of relatively low passenger volume, a horizontal diversion of these oppositive types of traffic will usually suffice. As the volume increases to somewhere in the vicinity of half million annual enplaning and deplaning passengers, it becomes necessary to

resort to a vertical separation of traffic, hence the two-level system. The mere cataloguing of these operational systems represents little in the way of new development; however, determining at what annual passenger volume to consider provision of a two-level scheme represents a stride in the right direction in the development of terminal building design criteria.

In conjunction with studying the space and location requirements of the public airlines and concessionaires we developed a diagram of terminal building space relationships. (SEE FIGURE II) Facility relationships incorporated in the diagram hold whether the building be a one-level or two-level system or whether it be a centralized or a consolidated system. The diagram, or schematic, makes no attempt to relate the size of one space with respect to the others. It depicts an orderly arrangement of facilities permitting easy and direct flow of passengers, baggage and visitors by locating facilities in their proper places for the function they must perform.

The space relationship diagram was developed because of an early established premise to avoid standard plans. We did not want a situation where the designer's hands would be tied. We felt he must be free of the stigma of standards and be able to retain this freedom to develop an individualized scheme for a particular site and community. Stereotyped plans were avoided as if they were poison, and incidentally over the protests of many.

The number and kind of spaces which should be included in any terminal building must, of necessity, be determined on the basis of such factors as present and forecasted airline traffic, system of terminal building operation, local conditions of visitor volume, and restaurant cuisine prevailing in the community.

Generally, a new terminal building should be built sufficiently large in the first stage of construction to accommodate the activities anticipated at the end of a 10-year period. Space thus provided may not be fully utilized at the outset, but this condition is compensated for by the advantages gained through accommodating traffic increases with no interruptions in service, and obviating frequent and costly additions to the building. The original construction should be considered as a stage of the final development, rather than the final development.

A study of activities at a representative group of airports revealed the existence of relationships between the number of annual passengers and the number of passengers accommodated during the typically busy or peak hours. The study also revealed that relationships existed between the number of typically-busy or peak-hour passengers and the number of visitors, concession customers, and occupants of public areas. The observed peak relationships varied with annual passenger volume, but for locations of like passenger volume, the peak relationships fell within a sufficiently narrow range to permit use of them for planning purposes. Because of the existence of these relationships and the development of methods for forecasting or estimating future passenger volume, the number of typical peak-hour passengers was selected as the basis for area determinations.

To arrive at an estimate of the number of typical peak-hour passengers at the end of the projection period to which the building is to be sized, it is necessary to: (1) Make a forecast of annual passenger volume at the end of the projection period; and (2) analyze current passenger activity at the airport. A survey and analysis of current activity at the airport, when the data are gathered on several typically busy days, will yield the typical peak-hour passenger volume (average number of passengers enplaning and deplaning during the busiest hours). It is desirable that at least 1 week's traffic - if

possible, several weeks - be analyzed to obtain typical peak hour activity. The individual airlines maintain accurate records of the number of passengers processed through the airport, and they have been very co-operative in supplying data to airport management on passenger activity. In addition to the analysis of hourly passenger activity, the total number of passengers enplaning and deplaning during the 12-month period preceding the date of the survey must be obtained.

When the aforesaid data have been gathered, an estimate can be made of the future number of typical peak-hour passengers on which the size of facilities should be based. To aid in making this estimate a graph was developed from studies of observed typical peak-hour passenger data, and plotted with reference to corresponding annual passenger volume. (SEE FIGURE III) Thus, the curve represents an average of the number of passengers accommodated during a typical peak hour for annual passenger volumes shown. It is "norm" to be employed only for the purpose of comparing a particular airport's passenger activity with nationwide averages of passenger activity. This comparison can be used as an aid in estimating typical peak-hour activity for the aforecasted annual volume. Once the target date and number of passengers and visitors to accommodate has been determined, the sizing of the various facilities can be reduced to a simple arithmetical calculation allowing unit areas per passenger, per visitor, or per customer as the case may be.

These unit area requirements were further tempered by time occupancy factors developed from observation and study of passenger, visitor, customer activity.

For easy usage of somewhat conglomerate factors and data, we plotted area requirements for the various facilities in terminal buildings against the number of typical peak hour passengers that would be using the space. (SEE FIGURE IV)

As for the future the fast growing, and fast changing aviation industry presents many problems. Jet transports which are fast approaching the point of daily schedules, not to mention atomic powered engines, which appear feasible within the foreseeable future will present further problems. The uncertainty of the unknown or unfamiliar, however, should not influence us to the point of burying our heads in the sand, and doing nothing <u>now</u> or at best erecting makeshift terminal buildings in the form of barn-like hangars.

Time limitations, because I am speaking by the clock rather than by a calendar, have precluded my going into details on this three year work of developing airport terminal building criteria. For those interested the C.A.A. publication "Airport Terminal Buildings", contains a relatively complete story. It is available through the Superintendent of Documents in Washington. I gratefully acknowledge the valuable assistance provided by Mr. Richard D. Seaborn for his review and assistance in the preparation of this paper. Mr. Seaborn was formerly Regional Architect for the C.A.A. and as such contributed heavily to the preparation, evaluation and review of the "Airport Terminal Buildings" booklet.

In closing I would like to leave this with you, -

In the design of an Airport Terminal Building, allot the "breaks" wisely, bearing in mind that <u>economic practicability</u>, <u>amortization potentialities</u>, and <u>functional efficiency</u> should be the prime considerations in the allocation of space and that <u>expansibility</u> and <u>flexibility</u> should be the prime considerations of design and construction of terminal buildings.

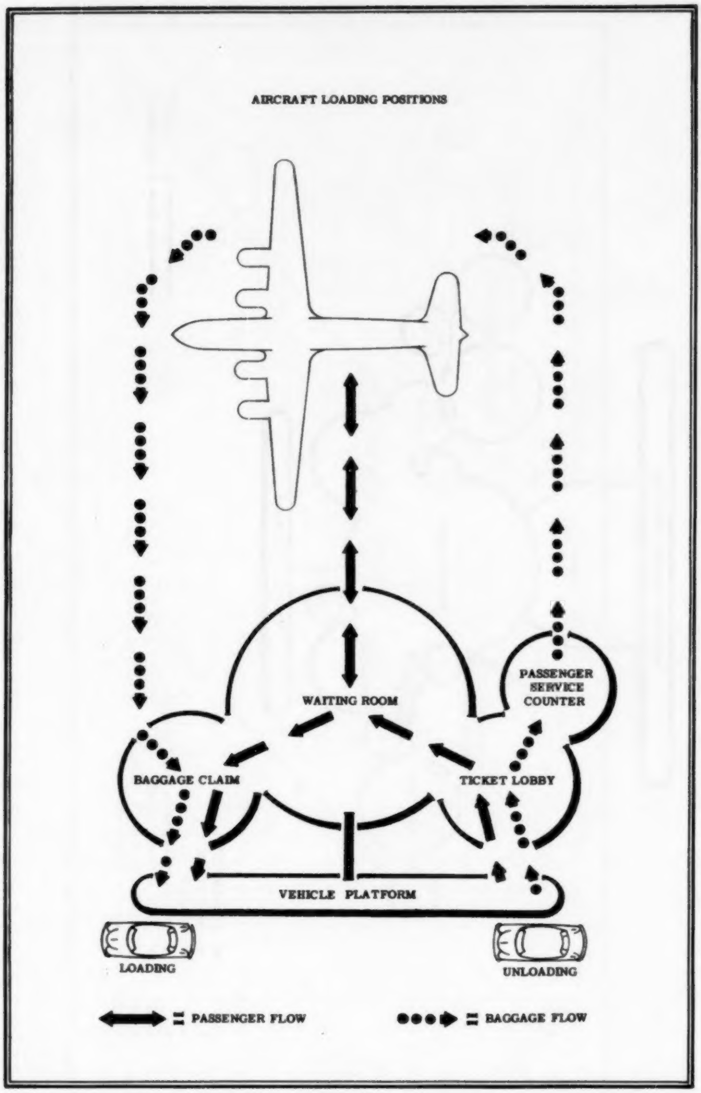
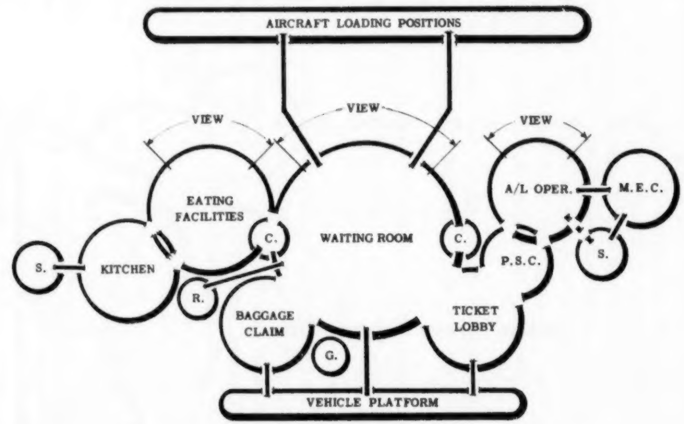


FIGURE 1 - PASSENGER AND BAGGAGE FLOW



LEGEND

C. = CONCESSIONS
R. = REST ROOMS
S. = SERVICE
G. = GROUND TRANSPORTATION DISPATCH
M.E.C. = MAIL, EXPRESS, CARGO
P.S.C. = PASSENGER SERVICE COUNTER
A/L OPER. = AIRLINE OPERATIONS

= DIRECT
= SECONDARY

FIGURE 2 - TERMINAL BUILDING SPACE RELATIONSHIPS

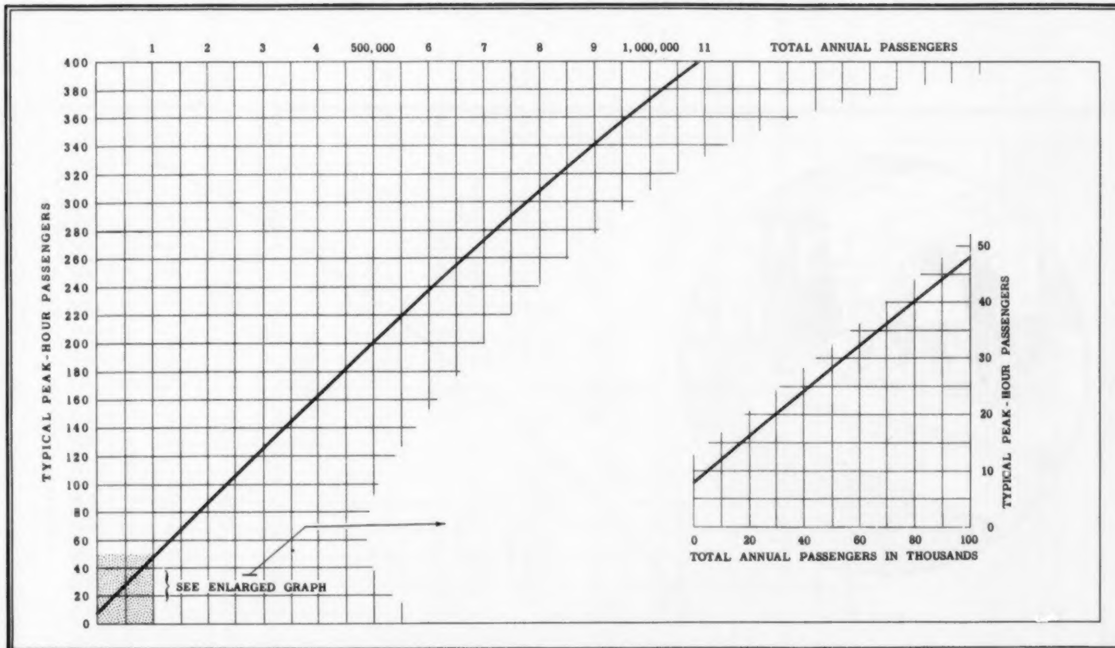


FIGURE 3 - TYPICAL PEAK-HOUR PASSENGERS RELATED TO ANNUAL PASSENGERS

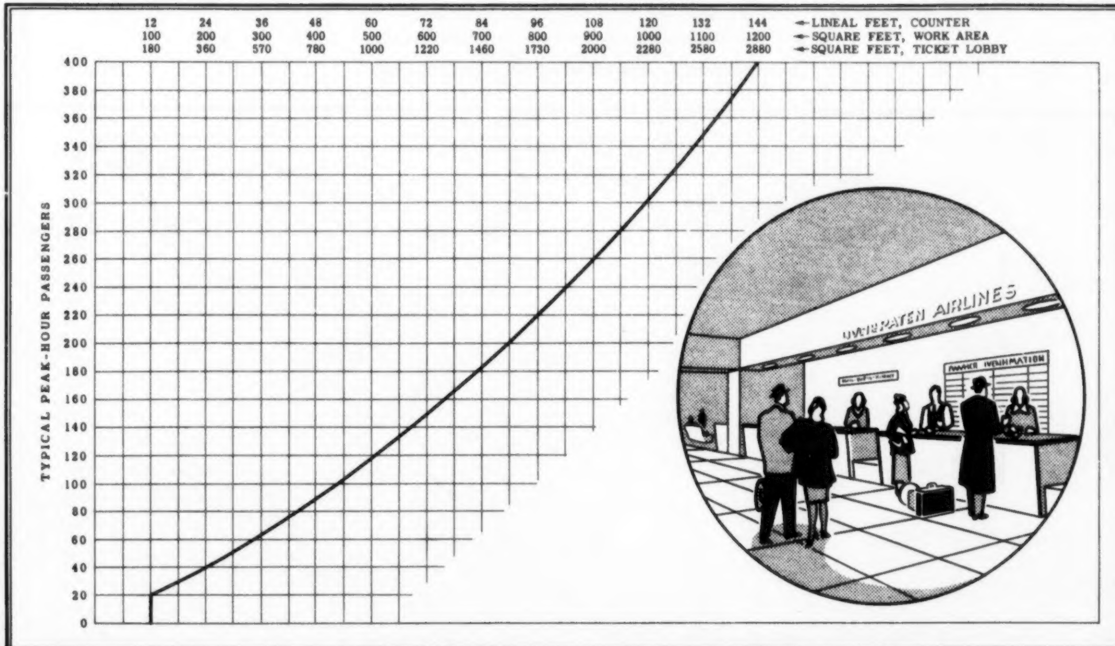


FIGURE 4 - PASSENGER SERVICE COUNTER, TICKET LOBBY

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VOLUME 79 (1953)

MARCH: 176(SA), 177(EM), 178(HY), 179(EM), 180(HY), D-123(HY), D-126(ST), D-128(ST).

APRIL: 181(WW), 182(ST), 184(HY), 185(EM), 186(HY), 187(ST), 188(HY), D-135(HY), D-136(ST).

MAY: 189(HY), 190(HY), 191(CP) & (AT), 192(SM), 193(HY), D-129(PO), D-138(CP), D-145(ST).

JUNE: 194(CP) & (AT), 195(SM), 196(CP) & (AT), 197(HY), 198(ST), 199(EM), D-134(HY), D-141(HY).

JULY:[a] 200(SM)[b], 201(ST)[b], 202(EM)[b], 203(SM)[b], 204(AT)[b], 205(EM)[b], 206(ST)[b], 207(SA)[b], 208(SA)[b], 209(ST)[b], 210(SU)[b], 211(EM)[b], 212(SU)[b], 213(IR)[b], 214(HW)[b], 215(SM)[b], 216(ST)[b], 217(ST)[b], 218(ST)[b], 219(ST)[b], 220(SM)[b], 221(HW)[b], 222(SM)[b], 223(EM)[b], 224(EM)[b], 225(EM)[b], 226(CO)[b], 227(SM)[b], 228(SM)[b], 229(IR)[b].

AUGUST: 230(HY), 231(SA), 232(SA), 233(AT), 234(HW), 235(HW), 237(AT), 238(WW), 239(SA), 240(IR), 241(AT), 242(IR), 243(ST), 244(ST), 245(ST), 246(ST), 247(SA), 248(SA), 249(ST), 250(EM)[c], 251(ST), 252(SA), 253(AT), 254(HY), 255(AT), 256(ST), 257(SA), 258(EM), 259(WW).

SEPTEMBER: 260(AT), 261(EM), 262(SM), 263(ST), 264(WW), 265(ST), 266(ST), 267(SA), 268(CO), 269(CO), 270(CO), 271(SU), 272(SA), 273(PO), 274(HY), 275(WW), 276(HW), 277(SU), 278(SU), 279(SA), 280(IR), 281(EM), 282(SU), 283(SA), 284(SU), 285(CP), 286(EM), 287(EM), 288(SA), 289(CO).

OCTOBER:[d] 290(all Divs), 291(ST)[c], 292(EM)[c], 293(ST)[c], 294(PO)[c], 295(HY)[c], 296(EM)[c], 297(HY)[c], 298(ST)[c], 299(EM)[c], 300(EM)[c], 301(SA)[c], 302(SA)[c], 303(SA)[c], 304(CO)[c], 305(SU)[c], 306(ST)[c], 307(SA)[c], 308(PO)[c], 309(SA)[c], 310(SA)[c], 311(SM)[c], 312(SA)[c], 313(ST)[c], 314(SA)[c], 315(SM)[c], 316(AT), 317(AT), 318(WW), 319(IR), 320(HW).

NOVEMBER: 321(ST), 322(ST), 323(SM), 324(SM), 325(SM), 326(SM), 327(SM), 328(SM), 329(HW), 330(EM)[c], 331(EM)[c], 332(EM)[c], 333(EM)[e], 334(EM), 335(SA), 336(SA), 337(SA), 338(SA), 339(SA), 340(SA), 341(SA), 342(CO), 343(ST), 344(ST), 345(ST), 346(IR), 347(IR), 348(CO), 349(SM), 350(HW), 351(HW), 352(SA), 353(SU), 354(HY), 355(PO), 356(CO), 357(HW), 358(HY).

DECEMBER: 359(AT), 360(SM), 361(HY), 362(HY), 363(SM), 364(HY), 365(HY), 366(HY), 367(SU)[e], 368(WW)[e], 369(IR), 370(AT)[e], 371(SM)[e], 372(CO)[e], 373(ST)[e], 374(EM)[e], 375(EM), 376(EM), 377(SA)[e], 378(PO)[e].

VOLUME 80 (1954)

JANUARY: 379(SM)[e], 380(HY), 381(HY), 382(HY), 383(HY), 384(HY)[e], 385(SM), 386(SM), 387(EM), 388(SA), 389(SU)[e], 390(HY), 391(IR)[e], 392(SA), 393(SU), 394(AT), 395(SA)[e], 396(EM)[e], 397(ST)[e].

FEBRUARY: 398(IR)[f], 399(SA)[f], 400(CO)[f], 401(SM)[f], 402(AT)[f], 403(AT)[f], 404(IR)[f], 405(PO)[f], 406(AT)[f], 407(SU)[f], 408(SU)[f], 409(WW)[f], 410(AT)[f], 411(SA)[f], 412(PO)[f], 413(HY)[f].

MARCH: 414(WW)[f], 415(SU)[f], 416(SM)[f], 417(SM)[f], 418(AT)[f], 419(SA)[f], 420(SA)[f], 421(AT)[f], 422(SA)[f], 423(CP)[f], 424(AT)[f], 425(SM)[f], 426(IR)[f], 427(WW)[f].

a. Beginning with "Proceedings-Separate No. 200," published in July, 1953, the papers were printed by the photo-offset method.
b. Presented at the Miami Beach (Fla.) Convention of the Society in June, 1953.
c. Presented at the New York (N.Y.) Convention of the Society in October, 1953.
d. Beginning with "Proceedings-Separate No. 290," published in October, 1953, an automatic distribution of papers was inaugurated, as outlined in "Civil Engineering," June, 1953, page 66.
e. Discussion of several papers, grouped by divisions.
f. Presented at the Atlanta (Ga.) Convention of the Society in February, 1954.

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